

CORALLIOPHILINE DIVERSITY AT MID-ATLANTIC SEAMOUNTS (NEOGASTROPODA, MURICIDAE, CORALLIOPHILINAE)

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ABSTRACT

Eleven species of the Coralliophilinae were identified on seamounts of the NE Atlantic and in the Azores. The species-level taxonomy is reviewed with emphasis on the protoconch species-specific characters. The Meteor group of seamounts yielded six species (plus two unidentified), with 3–6 species found sympatrically. *Babelomurex atlantidis* is described as new, *Coralliophila aedonia* (Watson, 1886), *Babelomurex sentix* (Bayer, 1971) and *B. dalli* (Emerson and D'Attilio, 1963) are reported for the first time in the mid-North Atlantic. Species which were found either abundant (*C. aedonia*, *B. sentix*, *B. atlantidis*) or reproducing (*B. dalli*) are assumed to form established populations on the mid-Atlantic seamounts. In the Lusitanian group of seamounts only Gorringe yielded more than one species; all species are shared either with the European mainland or with the Canary Islands, and there is no evidence for established populations. The coralliophiline species found on the seamounts showed evidence of planktotrophic larval development; at least two are amphiatlantic, which illustrates the role of the seamounts as stepping stones in transoceanic dispersal. Some species are not known outside the seamounts, but this may be explained by the increased availability of bathyal hard bottoms rather than by limitations to dispersal.

The Coralliophilinae include ca. 200 species of coral eating gastropods, distributed worldwide in tropical and temperate seas. Their placement within the family Muricidae, close to Rapaninae s.l. is strongly supported by molecular data (Oliverio and Mariottini, 2001a; Oliverio, Cervelli and Mariottini, 2002).

Here we review the coralliophiline material collected during the two *Seamount* expeditions (Figure 1) carried out with research vessels of the French marine research agency IFREMER. These cruises were aimed at general collecting of the benthic fauna and a better understanding of the colonization of isolated sites by the benthic species. *Seamount 1* was conducted in September/October 1987 by P. Bouchet (Muséum National d'Histoire Naturelle, Paris, hereafter MNHN) and involved sampling of Gorringe, Josephine, Ampère, Lion, and Seine seamounts (65 dredge hauls and 15 beam trawl operations on the Lusitanian seamounts; 11 dredge hauls and 1 beam trawl operation on Galicia bank; see Bouchet and Métivier, 1988). *Seamount 2* was conducted in January/February 1993 by the second author and involved sampling of the Great Meteor, Hyères, Irving (including Cruiser), Plato, Atlantis, and Tyro seamounts (69 dredge hauls and 16 beam trawl operations shallower than 1000 m, see Gofas, 1993). We also examined material collected in 1971 by the *Biaçores* expedition, conducted around the Azores under the direction of J. Forest (MNHN), and a small collection (leg. H. Zibrowius) from the slope of Madeira from the *Zarco* expedition of R/V JEAN CHARCOT in 1966. The locations of the general collecting sites are shown on Figure 1 and the details of locality coordinates given with material examined.

The material of the *Seamount* expeditions was sorted to the species level, on board for the coarser fraction and later at the lab down to the 0.5 mm mesh. The largest

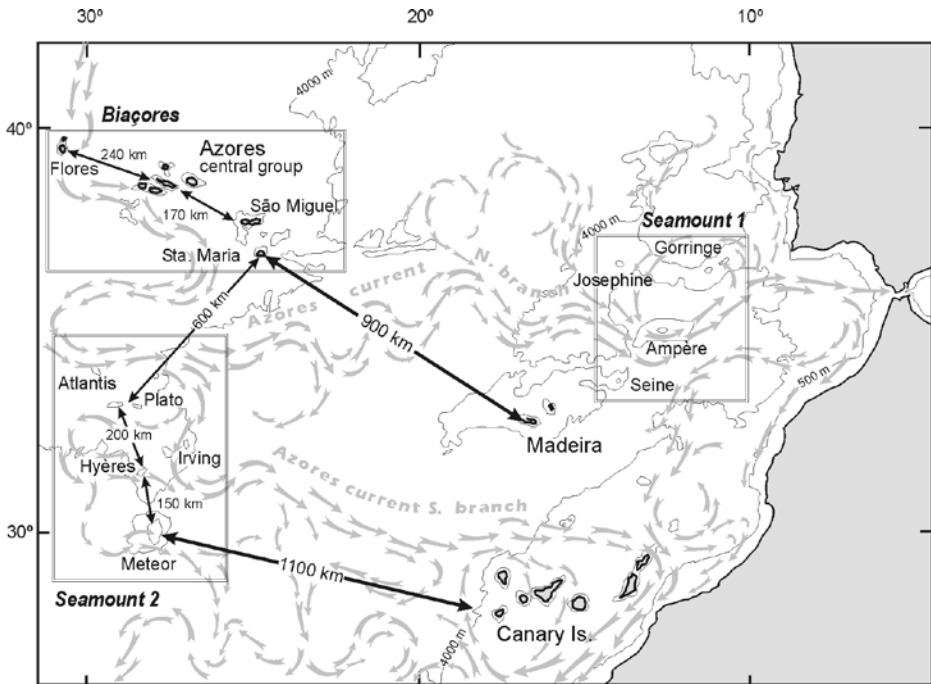


Figure 1. Map showing the location of the Northeast Atlantic seamounts and archipelagos. The arrows indicate the overall direction of near-surface water circulation, redrawn from a near-surface velocity model in Johnson and Stevens (2000).

part consisted of shells, and these were taken into account in the mollusc counts. The material from *Seamount 1* is shared between the Swedish Museum of Natural History, Stockholm, and MNHN; that of *Zarco*, *Biaçores*, and *Seamount 2* is deposited in MNHN.

The species-level systematics of coralliophilines is difficult because adult morphology shows broad intraspecific variability and is often influenced by the substrate. For this reason, particular attention was given to the protoconch morphology as a taxonomic character. The protoconch has many species-specific morphological features but is eroded or damaged in most adult specimens. In order to associate a particular larval shell morphology with the corresponding adults, we either selected shells where a protoconch is reasonably preserved on the adult, or used growth series in a single lot where the larval shell morphology could be traced to a conspecific adult. A purely conchological approach can be misleading (e.g. Oliverio et al. 2001b), however, so we have refrained from describing new taxa unless clear cut evidence was available.

Supraspecific systematics is still hampered by the lack of a reliable phylogenetic framework within the subfamily. For this study of species-level taxonomy in a regional fauna, we adopted a conservative taxonomy, and included the species in two commonly used “genera”: *Coralliophila* H. and A. Adams, 1853 and *Babelomurex* Coen, 1922.

ABBREVIATIONS AND CONVENTIONS USED.—MNHN: Muséum National d’Histoire Naturelle, Paris. USNM: United States National Museum, Smithsonian Institution, Washington D.C., U.S.A. Actual size (in figure captions) measured from the shell’s apex to the tip of siphonal canal. jv.: juvenile shell or specimen. sh.: shell,

collected without soft parts. spm: specimen, collected alive. sta.: sampling station (of a research cruise).

SYSTEMATICS

Superfamily Muricoidea Rafinesque, 1815

Family Muricidae Rafinesque, 1815

Subfamily Coralliophilinae Chenu, 1859

Genus *Coralliophila* H. and A. Adams, 1853 (s.l.)

Type species by subsequent designation (Iredale, 1912): *Fusus neritoideus* Lamarck, 1816.

There is strong molecular evidence that the genus *Coralliophila* as commonly conceived is polyphyletic (Oliverio and Mariottini 2001, Oliverio, Cervelli and Mariottini 2002), and should be restricted to the few species closely related to the type species. Species which may be included in the (sub)genus *Hirtomurex* Coen, 1922 (type species: *Fusus lamellosus* Philippi, 1836), form a rather well-defined group in the Indo-West Pacific (based on shell morphology: Oliverio, in press), yet they are not clearly distinguished from *Coralliophila* s.l. in the Eastern Atlantic. For this reason we have included the following eight species (plus the three unidentified taxa) in a genus *Coralliophila* (s.l.) pending a revision of their status with molecular markers.

Coralliophila meyendorffii (Calcara, 1845)

(Fig. 2)

Murex meyendorffii Calcara, 1845: p. 38, pl. 4 fig. 22 / type locality: Ognina near Catania, Sicily.
Pleurotomoides obliquispira Nordsieck, 1977: p. 62, pl. 21 fig. 163 / type locality: Ponta Delgada, Azores (30 m), new synonym.

Type Material.—*Murex meyendorffii*, whereabouts unknown; *P. obliquispira*, syntype in Naturmuseum Senckenberg, Frankfurt a. Main.

Material Examined.—Seine seamount: Poseidon 309 sta. BG1 (33°46.8'N, 14°24.9'W, 312 m): 1 juv. sh.

Azores, São Miguel (no further details) coll. H. Fischer ex Drouet, 1 sh (21.1 × 13.0 mm); São Miguel, off Ponta Delgada (10–20 m), coll. P. Bouchet 1983, 10 spm. (7.3 × 5.0 to 10.0 × 6.8 mm); São Miguel, Ilheu de Vila Franca do Campo, coll. S. Gofas 1988, 1 sh. (8.9 × 5.3 mm); Santa Maria, Ponta do Marvão (0–1 m), coll. S. Gofas 1990, 5 spm. (9.1 × 6.3 to 13.8 × 7.6 mm); Santa Maria, Praia Formosa, coll. S. Gofas 1990, 3 sh. (6.0 × 3.5 to 7.2 × 4.3 mm) + 1 juv. sh.; Santa Maria, São Lourenço (intertidal), coll. S. Gofas 1990, 2 spm. (14.2 × 8.4 mm, 10.4 × 7.3 mm); Flores, Santa Cruz in large tidal pool, coll. S. Gofas 1989, 1 sh. (8.3 × 5.4 mm).

Canary Is. Tenerife, Palm-Mar (intertidal), 1 juv. spm., coll. Bouchet and Gofas 1980.

Alboran Sea: Rincón de la Victoria, 2 larval sh.

Description.—Protoconch (description based on specimens from Alboran Sea and the Canaries) of ca. 4 whorls, maximum diameter 790 µm, white. Protoconch-I of 0.8

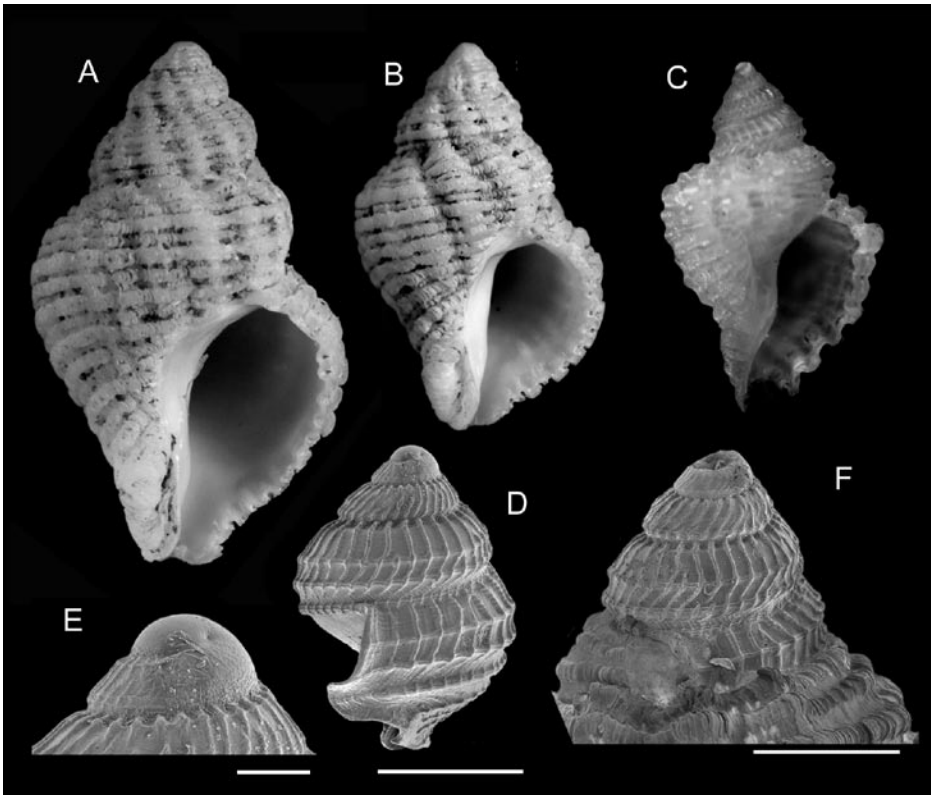


Figure 2. *Coralliophila meyendorffi* (Calcare, 1842). A,B: specimens from São Lourenço, Santa Maria, Azores (actual size 14.2 and 10.4 mm). C. Syntype (sh.) of *Pleurotomoides obliquispira* Nordsieck, 1977, from off Ponta Delgada, São Miguel, Azores (SMF; actual size 2.6 mm). D. Larval shell from Rincón de la Victoria, Alborán Sea. E. Detail of protoconch-I, same shell. F. Protoconch of a specimen from Palm Mar, Tenerife (scale bars for D,F: 500 μ m; for E: 100 μ m).

whorl, diameter ca. 170 μ m, with smooth apex and remainder of whorl somewhat granulose. Protoconch-II 3.2 whorls, with sculpture formed by two spiral keels and axial riblets. Abapical keel starting on first whorl of protoconch-II, adapical keel on next whorl. Suture distinctly sunken; slope from suture to adapical keel more than twice as broad as interspace between keels, slightly swollen at a short distance from the suture. Axial riblets somewhat beaded, narrower than interspaces, continuous, bridging the subsutural depression where they abut on the preceding whorl, and overriding the keels. Very fine spiral threads visible in the interspaces both on adapical slope and between keels; microsculpture between abapical keel and suture of next whorl of similar but oblique threads. Axial riblets on last whorl of protoconch-II like on earlier whorls. A third spiral keel, covered by the suture of spire whorls, visible only in prolongation of the suture on larval shells without teleoconch growth.

Remarks.—This is a common species, found associated mostly with littoral sea-anemones. We could ascertain, from specimens having recognizable protoconchs, its occurrence in the Mediterranean, in West Africa at least to Senegal, in the Canary Islands and the Azores. Its near absence on the seamounts was predictable, considering the absence of suitable environments and hosts.

Specimens from the Azores are smaller than usual in the Mediterranean and Canary Is., but otherwise similar. One juvenile shell from Praia Formosa has a recognizable protoconch displaying the diagnostic traits of the species (subsutural depression, riblets continuous on subsutural slope and also between keels). The name *Pleurotomoides obliquispira* Nordsieck, 1977 is based on a young specimen of *C. meyendorffii* from off Ponta Delgada, Azores.

There is some resemblance in general shape between this species and the Western Atlantic *Coralliophila aberrans* (C. B. Adams, 1850), described from Jamaica; the latter differs in having flatter cords, alternating stronger and weaker, and is unlikely to be conspecific.

Coralliophila squamosa (Bivona Ant. in Bivona And., 1838)

(Fig. 3)

Fusus squamosus Bivona Ant. in Bivona And., 1838: p. 14; fig. 22/type locality originally stated as Palermo and Messina, Sicily; type locality from neotype (Bouchet and Warén, 1985) Calvi, Corsica.

Murex alucoides Blainville, 1829: p. 128; pl. 5B fig. 1/type locality: Provence, France (preoccupied by *Murex alucoides* Olivi 1792)

Fusus lamellosus Philippi, 1836 ex de Cristofori and Jan ms.: p. 204–205, pl. 11 fig. 30 /type locality: Palermo and Messina, Sicily (preoccupied by *Fusus lamellosus* Borson 1821)

Fusus squamulosus Philippi, 1836: p. 204, pl. 11 fig. 31/type locality: Palermo, Sicily (possibly subfossil) (preoccupied by *Fusus squamulosus* Deshayes, 1835)

? *Pseudomurex perfectus* Fischer P., 1883: p. 274 /type locality: Bay of Biscay, “Travailleur” 1881 sta. 37 (44°10'N, 08°18'W, 400 m)

? *Pseudomurex ruderatus* Sturany, 1896 ex Monterosato ms.; p. 26, pl. 2 fig. 42–43/type locality: not stated [Corsica fide Bouchet and Warén, 1985].

? *Pseudomurex monterosatoi* Locard, 1897: p. 315, pl. 15 fig. 21–23/type locality: Bay of Biscay, “Travailleur” 1882 sta. 1–2 (44°05'–07'N, 05°35'W, 564–608 m).

Type Material.—*Fusus squamosus*, neotype (Bouchet and Warén, 1985) in MNHN, Paris. *Pseudomurex ruderatus*, syntypes in Naturhistorisches Museum, Wien; *P. monterosatoi*, syntypes in MNHN, Paris

Material Examined.—Gorringe seamount: *Seamount 1* sta. DW21, 36°35'N, 11°28'W, 460–480 m, 1 sh. (18.0 × 9.3 mm).

Description.—Protoconch (description based on specimens from Alboran Sea, Fig. 3C–E) of ca. 3.5 whorls, maximum diameter 760 µm, pale straw color. Protoconch-I of 0.8 whorl, diameter ca. 230 µm, covered with strong, close-set flat granules. Protoconch-II 2.7 whorls, with sculpture formed by two spiral keels and axial riblets. Abapical keel starting on first whorl of protoconch-II, adapical keel hardly expressed except on last protoconch whorl. Slope from suture to adapical keel slightly swollen at a short distance from suture, more than twice as broad as interspace between keels. Axial riblets neatly beaded, narrower than interspaces, continuous on adapical slope, then abruptly interrupted. A few intercalary riblets as thick as the others but starting on mid-slope or close to the adapical keel. Abapical keel with distinct knobs aligned axially with the riblets, flanked by two smooth spiral grooves. Very fine spiral threads visible on adapical slope, near the termination of riblets (i.e. along a spiral line preceding the adapical keel of last whorl). Axial riblets on last whorl of

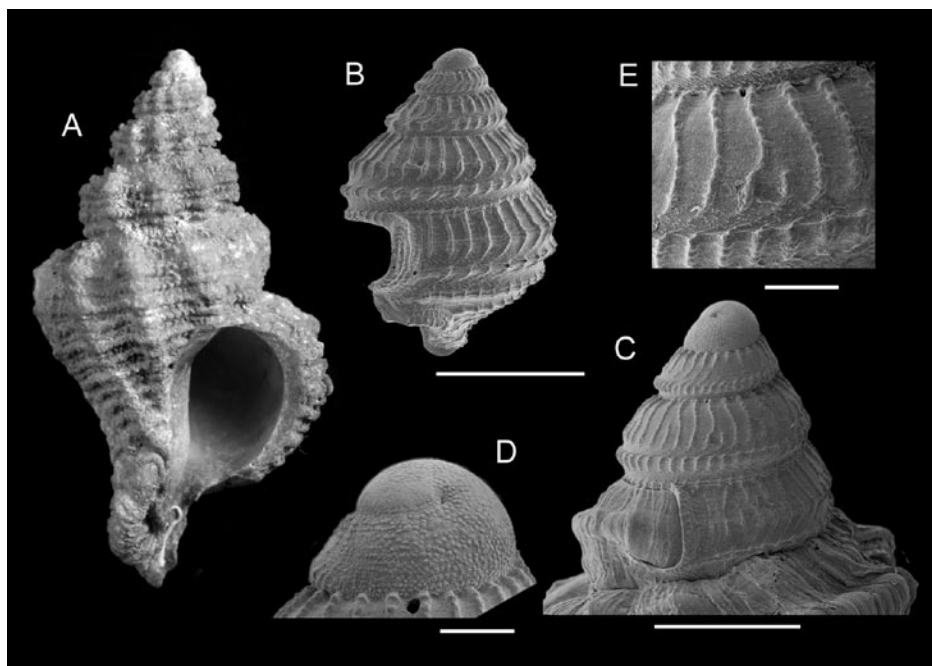


Figure 3. *Coralliophila squamosa* (Bivona, 1838). A. Shell from Gorringer seamount DW21, 460–480 m (actual size 18.0 mm). B. Larval shell approaching the morphology of *C. squamosa*, from Atlantis seamount DW255, 340 m. C. Protoconch of a specimen from Alborán Island, Western Mediterranean Sea. D. Detail of protoconch-I, same specimen. E. Detail of ribs on protoconch-II, same specimen (scale bars for B,C: 500 μ m; for D,E: 100 μ m).

protoconch-II like on earlier whorls but overriding a more definite adapical keel. A third spiral keel, concealed by the suture of spire whorls, visible only in prolongation of the suture on larval shells without teleoconch growth.

Remarks.—We collected only one old shell, on Gorringer seamount (Fig. 3A). We include for comparison a description of the larval shell, based on a well identified population collected near Alborán Island, Mediterranean Sea. The protoconch of *C. squamosa* is quite unusual among those known so far for coralliophilines, diagnosed by the uninterrupted beaded riblets on the adapical slope and the two smooth grooves bordering the abapical keel. Among the European species, it only resembles that of *C. meyendorffi* in having continuous beaded riblets on the slope, but the latter is stouter, has a distinctly sunken suture and has the riblets continued in the grooves bordering the abapical keel.

We did not find evidence of any established populations of *C. squamosa* in the seamounts, which may be explained by excessive depth or by the absence of an appropriate host (not precisely known in the rest of the range). Several larval shells from Atlantis approach somewhat the morphology of *C. squamosa* (Fig. 3B) in having beaded axial ribs and two smooth grooves flanking the abapical keel. The unidentified larval shells from Curaçao illustrated by Bouchet and Warén (1985: 157) closely resemble those illustrated here from Atlantis. Both differ from the Mediterranean *C. squamosa* in being less elongate, with a flatter adapical slope, a definite adapical keel (not just a line made up by the termination of axial riblets), thicker and non-branching riblets and thus are probably not the same species (they could be *C. basileus*, see

that species). This may cast some doubt on the supposed amphi-Atlantic status of the species. Nevertheless, the holotype of *Trophon lintoni* Verrill and Smith in Verrill, 1884 (p. 176, pl. 29 fig. 1) agrees fairly well in size and shape with Mediterranean *C. squamosa* and was found in a depth of 70 fathoms [130 m] in the expected range.

The Caribbean specimen attributed to *C. squamosa* illustrated by Bayer (1971: 192–193, as *C. lamellosa*) more closely resembles *C. basileus* (see that species) and was collected at a depth (695–772 m) where the latter species would be expected.

Coralliophila guancha Smriglio, Mariottini and Engl, 2003

(Fig. 4A–D)

Coralliophila guancha Smriglio, Mariottini and Engl, 2003: p. 39–42/type locality: Puerto del Carmen, Lanzarote, Canary Is.

Material Examined – Azores: São Miguel, *Biaçores* sta. P5, Capelas (18 m), 1 spm. (10.5 × 8.0 mm); Feteiras, in cave (20 m), leg. Zibrowius 8/1979, 2 spm (9.7 × 6.4, 12.7 × 10.0 mm) Madeiran archipelago, Porto Santo: *Zarco* sta. 21 (33°00.7' N, 16°25.5' W, 220–290 m), 1 sh. (7.8 × 5.0 mm).

Description (based on Azores and Madeira material).—Protoconch of 3.3 whorls, maximum diameter 700 µm, with intense reddish hue. Protoconch-I of 1 whorl, diameter ca. 290 µm, without apparent sculpture (may be eroded). Protoconch-II of 2.3 whorls, with sculpture formed by two spiral keels and faint axial riblets. Abapical keel conspicuous on the first whorl of protoconch-II, adapical keel starting on next whorl, at the time the abapical keel becomes less pronounced. Slope from suture to adapical keel slightly convex, about twice as broad as the interspaces between keels. Axial riblets faint, overriding the keels and giving them a serrated appearance. A third spiral keel visible along the suture on last whorl of protoconch-II. Faint spiral threads running over the keels on last whorl.

Teleoconch in juvenile shells sharply angulated at the periphery, peripheral keel persisting in the mature adults.

Remarks.—*Coralliophila africana* Smriglio and Mariottini, 2001, was described from the holotype collected in Sierra Leone, West Africa and one paratype from the Alboran Sea, Western Mediterranean basin. These shells closely resemble *C. guancha* notwithstanding some differences in the shell sculpture which may, or not, warrant specific distinction. In particular, *C. africana* has stronger cords and lacks the scales which are well developed on the outer part of the siphonal canal.

Coralliophila kaofitorum Vega, Vega and Luque, 2002

(Fig. 4E)

Coralliophila kaofitorum Vega, Vega and Luque, 2002: p. 50–55/type locality: Punta de Teno (28°20' N, 17°55' W, 22–24 m), Tenerife, Canary Is.

Material Examined.—Gorringe seamount: *Seamount 1* sta. DW05 (36°32' N, 11°38' W, 180 m), 1 sh. (16.0 × 11.5 mm).

Remarks.—Only one specimen from Gorringe seamount could be identified with this species, known to live associated with Antipatharians. The protoconch described

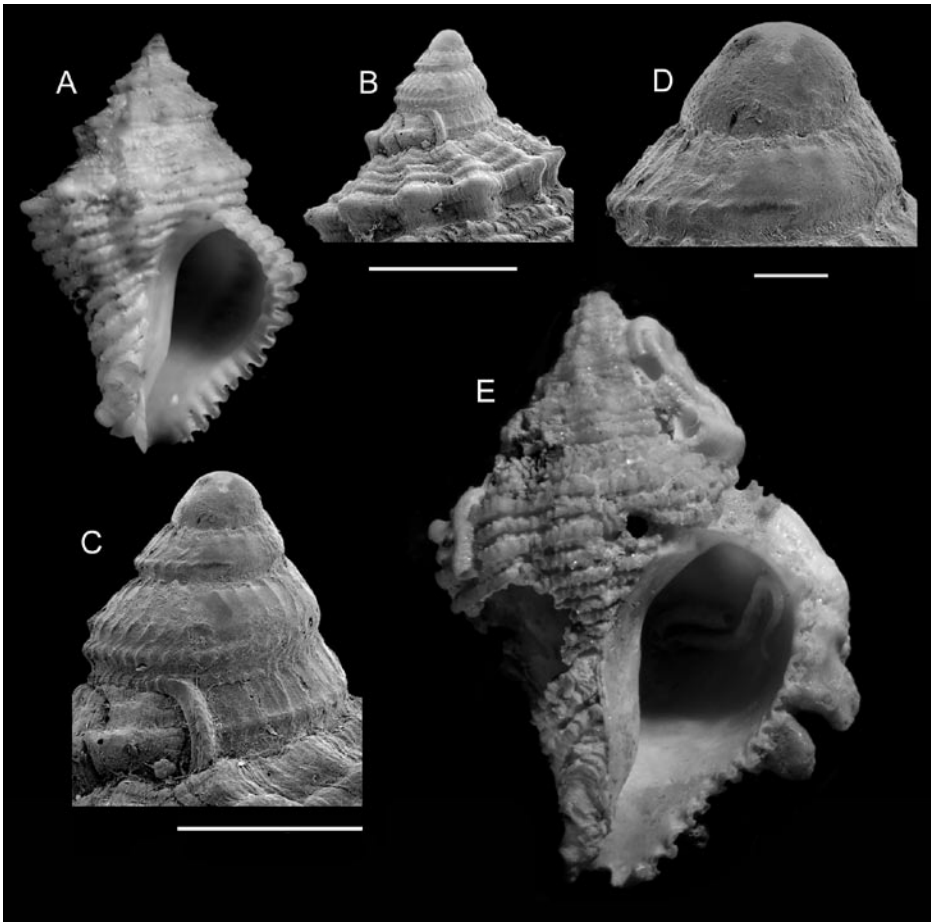


Figure 4. A. *Coralliophila guancha* Smriglio, Mariottini and Engl, 2003, specimen from Feteiras, São Miguel, Azores, in cave at 20 m depth (actual size 9.7 mm). B. Apical whorls, same specimen. C. Protoconch, same specimen. D. Detail of protoconch-I, same specimen (scale bars for B: 1 mm; for C: 500 μ m; for D: 100 μ m). E. *Coralliophila kaofitorum* Vega, Vega and Luque, 2002, shell from Gorringe seamount DE09, 350–360 m (actual size 16.0 mm).

by Vega et al. (2002) is of a dark reddish hue like that of *C. guancha* but differs in being narrower, in that the adapical slope is hardly broader than the space between keels, and in more bulging protoconch-I.

Coralliophila aedonia (Watson, 1886)

(Figs. 5, 6)

Murex (Pseudomurex) aëdonius Watson, 1886: p. 181–182, pl. 17 fig. 5/ type locality: off Nightingale Is., South Atlantic 100–150 fathoms (182–274 m).

?*Coralliophila profundicola* Haas, 1949: p. 69–70/type locality: off Bermuda (32°08.2' N, 64°33' W, 1700 fathoms).

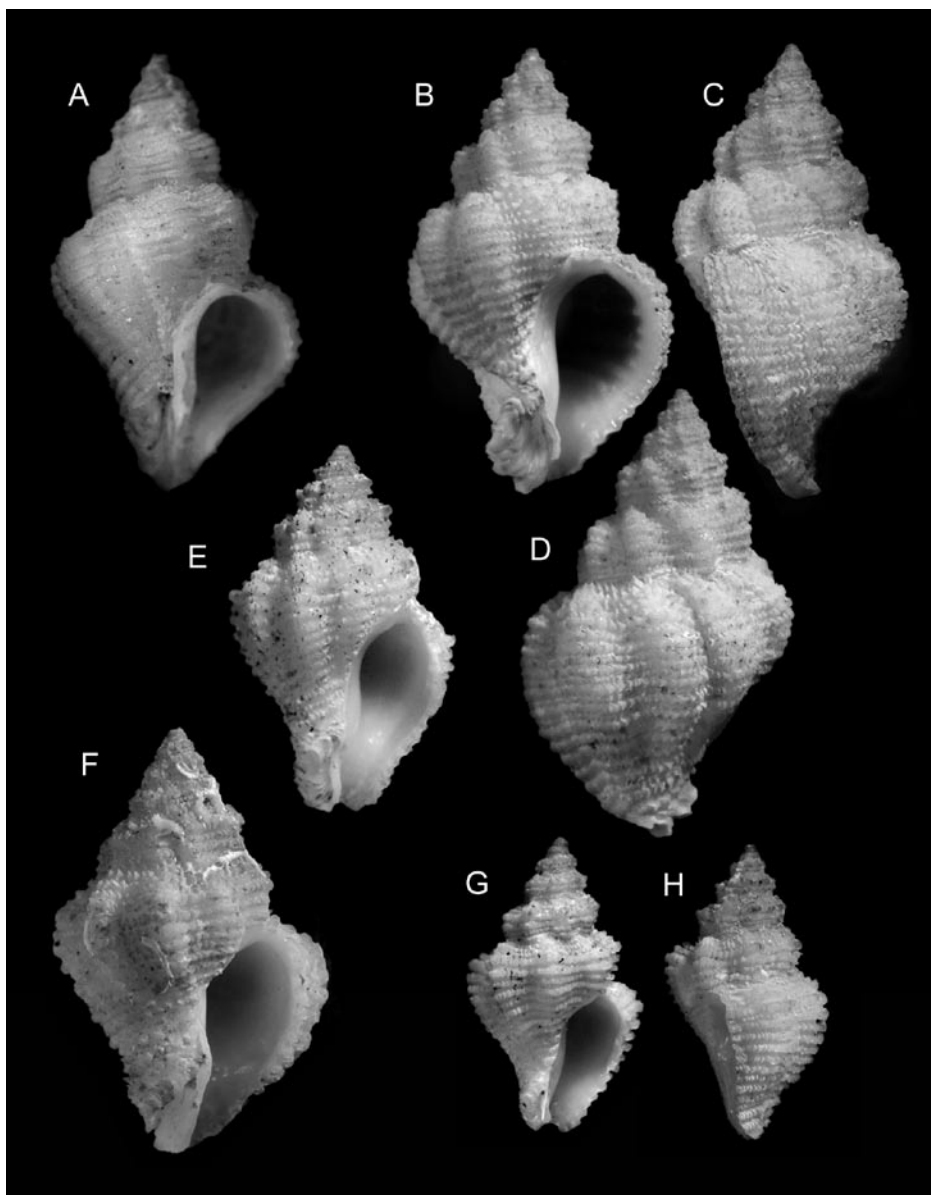


Figure 5. *Coralliophila aedonia* (Watson, 1886). A. Holotype (sh.) from off Nightingale Is., CHALLENGER sta. 135C, 100–150 fathoms (182–274 m)(actual size: 15.7 mm). B–D. Specimen from Hyères seamount DW184, 705 m (actual size 20.0 mm). E. Specimen from Meteor seamount DW179, 730 m (actual size 12.3 mm). F. Specimen from Atlantis seamount DW255, 340 m (actual size 14.3 mm). G–H. Specimen from Tyro seamount DW279, 805 m (actual size 10.5 mm).

Type Material.—*Murex aedonius*, holotype BMNH 1887-2-9-555 from CHALLENGER sta. 135C (15.7 × 9.1 mm); *C. profundicola*, holotype in Field Museum of Natural History, Chicago, n° 31655, figured in Kosuge and Suzuki (1985).

Material Examined.—Meteor seamount: *Seamount 2* sta. DW143 (30°09.9'N, 28°28.1'W, 330 m), 1 juv. sh.; sta. DW 166 (29°36.0'N, 028°22.8'W, 575 m), 1 sh. (13.4 × 8.0 mm); sta. DW179 (30°00.6'N, 28°42.3'W, 730 m), 1 sh. (12.3 × 7.1 mm).

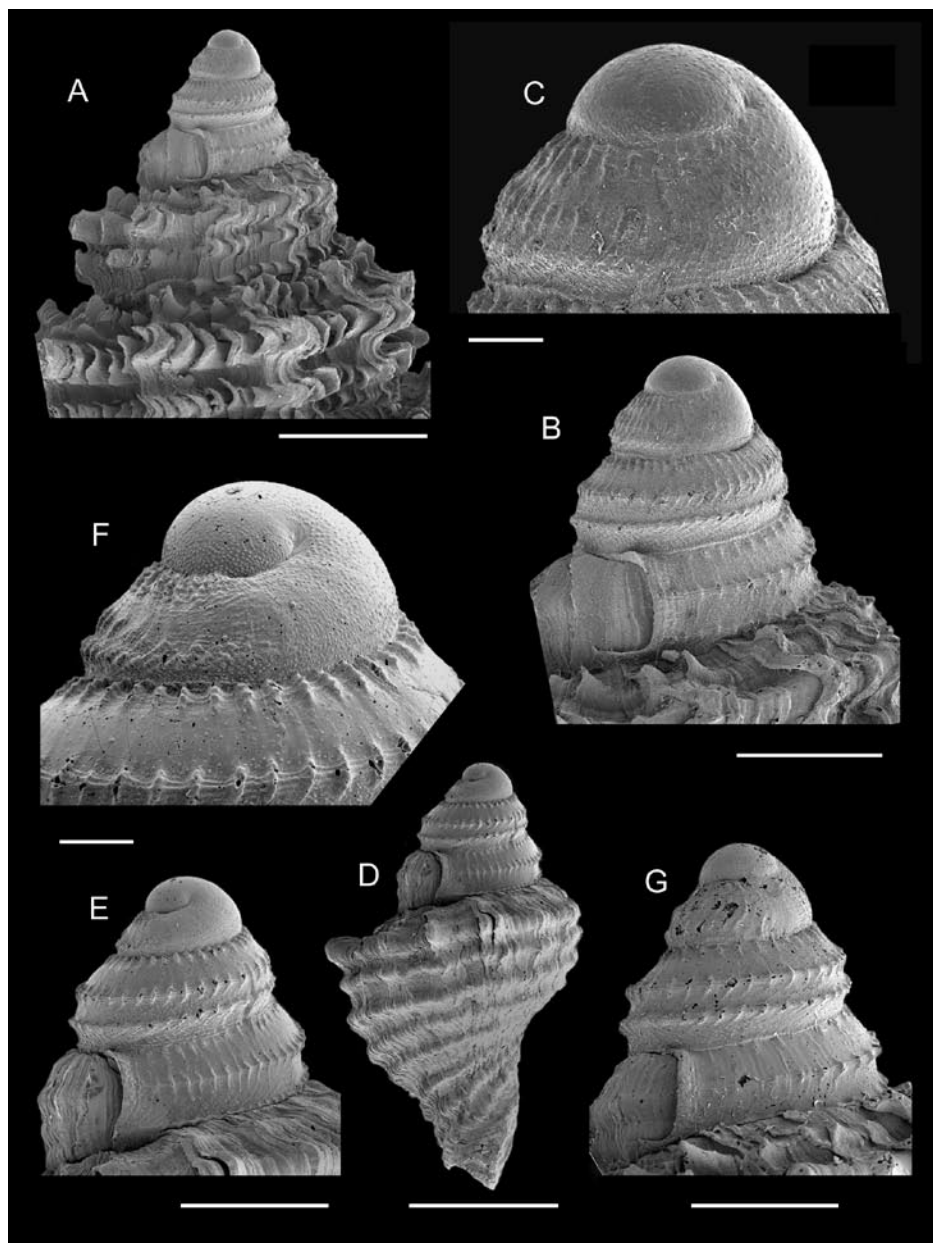


Figure 6. *Coralliophila aedonia* (Watson, 1886). A. Top whorls of a specimen from Hyères seamount DW184, 705 m. B. Protoconch, same specimen. C. Detail of protoconch-I, same specimen. D. Juvenile shell from Tyro seamount DW278, 890 m. E. Protoconch, same shell. F. Detail of protoconch-I, same shell. G. Protoconch of another shell from DW278 (scale bars to scale with other SEM plates; for A,D: 1 mm; for B,E,G: 500 μ m; for C,F: 100 μ m).

Hyères seamount: *Seamount 2* sta. DW184 (31°24.4'N, 28°52.3'W, 705 m), 9 sh. (8.8 \times 5.4 to 20.0 \times 11.7 mm); sta. DW203 (31°09.5'N, 28°43.5'W, 845 m), 2 sh. (14.5 \times 8.7 mm; 5.5 \times 3.0 mm).

Irving seamount: *Seamount 2* sta. DW209 (31°59.2'N, 27°55.9'W, 460 m), 1 sh. (6.3 \times 3.9 mm); sta. DW 221 (32°17.8'N, 28°15.3'W, 1180 m), 1 old sh. (20.7 \times 11.2

mm); sta. DW222 (32°20.8'N, 28°15.7'W, 1150 m), 1 old sh. (21.7 × 11.6 mm); sta. DW225 (32°08.6'N, 28°10.7'W, 1035 m), 1 sh. (20.5 × 11.6 mm, apex broken); DW226 (32°06.7'N, 28°08.8'W, 580 m), 1 spm.

Plato seamount: *Seamount 2* sta. DW246 (33°13.9'N, 29°36.1'W, 520 m), 1 sh. (16.5 × 10.7 mm).

Tyro seamount: *Seamount 2* sta. DW278 (33°57.8'N, 28°22.4'W, 890 m), 5 jv. sh.; sta. DW279 (33°55.6'N, 28°23.7'W, 805 m), 5 spm. (9.0 × 5.3 to 14.7 × 8.2 mm).

Atlantis seamount: *Seamount 2*: sta. DW254 (34°05.3'N, 30°13.4'W, 280 m), 1 jv. sh.; sta. DW255 (34°04.9'N, 30°15.3'W, 340 m), 1 spm. (14.3 × 9.0 mm) + 2 jv. sh.; sta. DW262 (34°23.4'N, 30°29.1'W, 1160 m), 1 sh. (16.3 × 9.7 mm)

Azores: *Biaçores* 1971 sta. DR230, SW of Santa Maria (36°54.0'N, 25°09.5'W, 665–712 m): 1 sh. (9.2 × 6 mm).

Description.—Protoconch of 3.3 whorls, maximum diameter 840 µm. Protoconch-I 0.9 whorls, diameter ca. 390 µm, with pustules all over the surface. Protoconch-II 2.4 whorls, with sculpture formed by two spiral keels and small, interrupted axial riblets. Abapical keel starting on first whorl of protoconch-II, adapical keel on next whorl. Slope from suture to adapical keel rather flat, slightly broader than interspace between keels. Axial riblets faint, interrupted, with one component forming a sub-sutural series, the other abutting on the keels and overriding them, giving them a serrated appearance. Axial riblets tending to be restricted to the subsutural line and the keels, and more crowded, on last whorl of protoconch-II. Sinusigera well-marked at the protoconch-teleoconch boundary.

Remarks.—There is an abundant representation of this species in mid-depths (450–1200 m) around the Meteor group of seamounts; the shallowest find of a living specimen was in 340 m on Atlantis. The protoconch (Fig. 6) is remarkable due to the large size of protoconch-I. The identification of *C. aedonia* may be surprising considered the remote type locality. Nevertheless, planktotrophic development in this genus is compatible with such a wide distribution. Also, *Coralliophila* is mainly a tropical/temperate group and it is likely that the specimen from Nightingale Island was extending far away from the primary range of the species. *Coralliophila profundicola*, which was described from a single specimen collected off Bermuda, is probably the same species; the holotype is an old, worn shell certainly transported downslope to the considerable depth where it was collected.

Coralliophila basileus (Dautzenberg and Fischer, 1896)

(Fig. 7)

Pseudomurex basileus Dautzenberg and Fischer, 1896: p. 440, pl. 18, fig. 3/type locality: off Azores (38°33'N, 28°08'W, 1300 m).

Type Material.—Holotype from sta. Monaco 233, in Musée Océanographique de Monaco.

Material Examined.—Hyères seamount: *Seamount 2* sta. DW182 (31°23.2'N, 28°53.5'W, 480 m), 3 jv.; sta. DW200 (31°19.1'N, 28°36.0'W, 1060 m), 1 sh. (6.9 × 4.5 mm).

Irving seamount: *Seamount 2* sta. DW222 (32°20.8'N, 28°15.7'W, 1150 m), 1 sh. (22.1 × 12.9 mm); sta. DW238 (32°17.3'N, 27°32.3'W, 890 m), 1 jv.

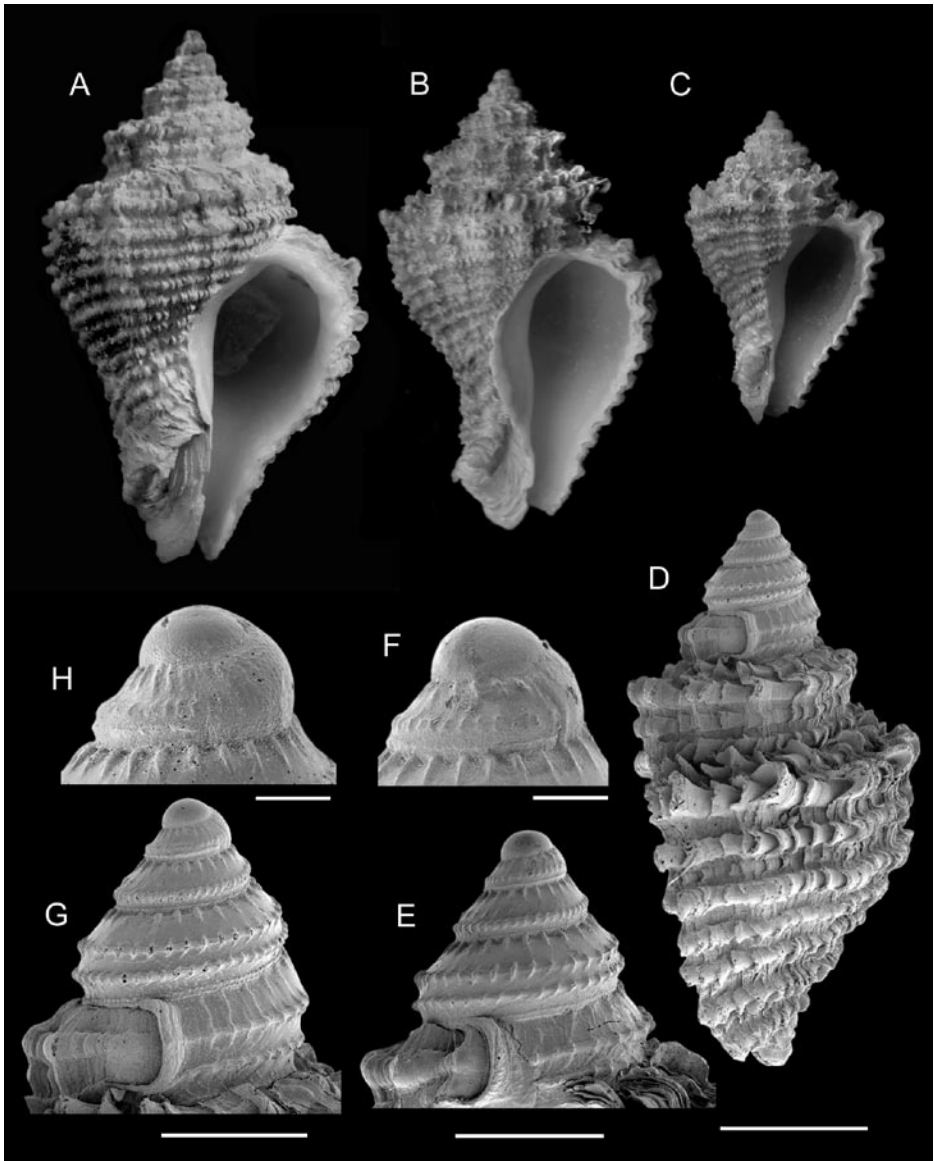


Figure 7. A. *Coralliophila basileus* (Dautzenberg and Fischer, 1896), specimen from off São Miguel, Azores, *Biaçores* sta. 180, 1239–1069 m (actual size 24.0 mm). B–C. Specimens from off NW Morocco, *Balgim* sta. CP97, 1515 m (actual sizes 20.7 and 14.1 mm). D. Juvenile shell possibly belonging to *C. basileus*, from Hyères seamount DW182, 480 m. E. Protoconch, same shell. F. Detail of protoconch-I, same shell. G. Protoconch of another shell from DW 182. H. Detail of protoconch-I, same as G (scale bars for D: 1 mm; for E,G: 500 μ m; for F,H: 100 μ m).

Azores: *Biaçores* 1971 sta. 4, 38°11.5'N, 028°38.5'W, 1200–1080 m, 1 spm. (27.2 \times 17.2 mm); sta. 180, 37°57.5'N, 025°33.0'W, 1235–1069 m, 2 spm. (23.7 \times 14.1 mm, 20.3 \times 12.2 mm).

Morocco: off Rabat, BALGIM sta. CP97 (34°25'N, 07°41'W, 1515 m), 2 spm. (20.7 \times 12.5 mm, 14.1 \times 8.9 mm).

Description.—Shell up to 27×17 mm, fusiform. Protoconch not known (see remarks). Teleoconch of 6–7 whorls, with conical spire and convex whorls. Spire whorls distinctly shouldered, body whorl with the shoulder attenuated and a profile gently tapering towards the siphonal canal. Subsutural ramp well defined, rather flat. Siphonal canal rather straight with a hardly prominent fasciole and without an umbilical chink.

Sculpture on the teleoconch whorls consisting of strong, elevated and squamose spiral cords, and of axial folds. Spiral sculpture with interspaces nearly as broad as the cords; one cord along the shoulder definitely stronger, the other cords alternating stronger and weaker at some stages of growth; later on the weaker cords tend to equate the others. Axial folds poorly defined, orthocline, marked with more developed scales of the cords where crossing the shoulder. Aperture gradually tapering towards siphonal canal, rounded adapically; outer lip simple, slightly notched between termination of spirals on mid-grown specimens, smooth on aged ones. Profile of aperture receding on the adapical side next to the parietal insertion, salient along its outer part between that embayment and the siphonal canal.

Remarks.—The holotype of this species is a large, aged specimen collected off the Azores, and our interpretation is based on the material from *Biaçores* including a range of moderately grown to aged specimens. Accordingly the species is distinguished from the Mediterranean and Lusitanian species *C. squamosa* by a proportionally greater development of the body whorl (over 70% of total height, usually even over 75%, instead of 65%–70%). The profile is also different, gently narrowing towards the relatively long siphonal canal, not with an inflated body whorl and a definite constriction around the canal as in *C. squamosa* and others. Other differential traits are the shoulder situated quite close to the suture, demarcating a rather flat ramp which is not seen in *C. squamosa*, and the embayment in the adapical part of the aperture.

Some of the specimens illustrated by Bouchet and Warén (1985) may not be conspecific. Their fig. 364 is an undetermined species represented by two lots from *Biaçores*, differing in having a high spire, shorter body whorl, and less squamose cords; their Fig. 366 matches our concept of *C. aedonia*. Conversely, the specimens illustrated by Bayer (1971: 193) as *Coralliophila lamellosa*, collected off Yucatán in 695–772 m, and by Bouchet and Warén (1985: fig. 359) as *C. squamosa* are probably this species.

The dominating squamose spiral sculpture (with the nearly total lack of axial sculpture) is shared with a group of species which may be ascribed to the genus *Hirtomurex*; it is very similar to some Indo-West Pacific species of this group (mostly undescribed), such as *Hirtomurex kawamurai* (Shikama, 1978) and *H. isshikiensis* (Shikama, 1971).

We could not associate with certainty a particular protoconch morphology with this species. Two kinds of protoconchs, which were found in the area, could possibly belong to *C. basileus*. One type, which we cannot distinguish from *Coralliophila brevis*, is illustrated on figures 7D–H. If this were verified, it would support the suggestion by Bouchet and Warén (1985) that *C. basileus* and *C. brevis* are related; the latter species was not found as adults in the Meteor group of seamounts nor in the Azores. Another possible candidate is the protoconch resembling *C. squamosa* (figure 3B) found on Atlantis seamount. Actually the material of adult *C. basileus* comes mostly from the Azores, not from the seamounts, so that the question might only be solved by further collections in the bathyal of the Azores including the fine fractions.

Coralliophila basileus is found in relatively deep water. On the continental slope of NW Africa where the two species are sympatric, its bathymetric range is deeper than that of *C. squamosa*, which is a circalittoral species.

Coralliophila brevis (Blainville, 1832)

(Fig. 8A–G)

Purpura brevis Blainville, 1832: p. 233, pl. 11 fig. 10/type locality: Sicily.

Pyrula squamulata Philippi, 1836: p. 207, pl. 11 fig. 21/type locality: Palermo, Sicily.

Pyrula santangeli Maravigna, 1840: p. 325–326/type locality: Messina, Sicily.

Pyrula borbonica Maravigna, 1842: p. 89–91, and unnumbered plate/type locality: Messina (objective synonym of *P. santangeli*).

Material Examined.—Mediterranean and Western European mainland. Portugal, off Tavira, Pedra do Barril (37°02.4'N, 07°39.7'W, 25 m), 7 spm. (7.9 × 5.3 to 15.4 × 11.8 mm). Strait of Gibraltar: Ceuta, off Punta Almina (35°54.1'N, 05°16.5'W, 25–40 m, leg. Bouchet 1986), 1 spm. (14.4 × 11.5 mm); Corsica: off Punta Revellata, Calvi, 1 spm leg. Bouchet, 1980 (13.0 × 9.0 mm).

Josephine seamount: *Seamount 1* sta. DW61 (36°40'N, 14°16'W, 200–205 m), 1 spm. (11.2 × 8.7 mm) and 2 ju. sh.

Ampère seamount: *Seamount 1* sta. CP99 (35°04'N, 12°55'W, 225–280 m), 2 sh. (14.7 × 9.7 mm, 15.2 × 8.7 mm).

Description.—Protoconch of ca. 4.3 whorls, maximum diameter 810 µm, a pale straw color. Protoconch-I of 1 whorl, diameter ca. 200 µm. with very fine granules or without apparent sculpture (may be eroded). Protoconch-II 3.3 whorls, with sculpture formed by two spiral keels and small, interrupted axial riblets. Abapical keel conspicuous on the two first whorls of protoconch-II, adapical keel starting on the third whorl. Slope from suture to adapical keel flat and shiny, twice as broad as interspace between keels. Axial riblets interrupted, developed only next to the suture and again where overriding the keels, to which they give a serrated appearance. A third spiral keel, concealed by the suture of spire whorls, visible only in prolongation of the suture on larval shells without teleoconch growth. Interspaces of keels with diffuse wrinkles.

Remarks.—The protoconch of this species is diagnosed by a broad, shiny slope with interrupted axial riblets on the adapical part of the whorls. A very similar morphology is seen on the protoconch of the Mediterranean *C. panormitana*, differing only by an earlier onset of the second keel (Fig. 8H–I). The adult morphology of the latter is nevertheless very different, with smaller spiral cords, no keel and a non-distorted body whorl.

Juvenile shells of *C. brevis* are sharply angulated at the periphery, and the peripheral keel persists in the mature adults. This species may thus resemble *C. kaofitorum* in the general outline, and in becoming rounded and deformed on old specimens, but is readily distinguished by the protoconch which is larger, pale in color and has the adapical keel formed only on the third protoconch-II whorl.

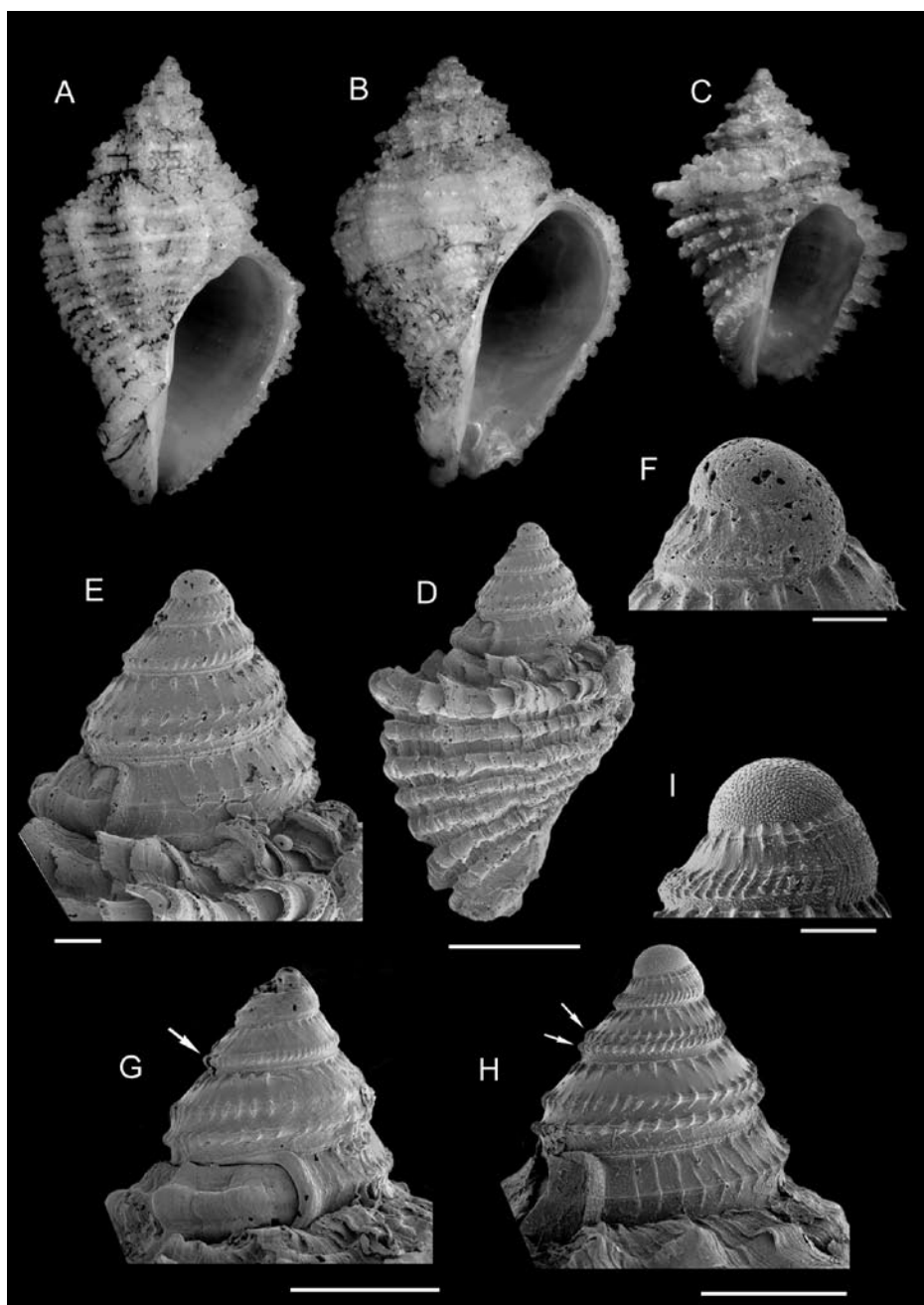


Figure 8. A,B. *Coralliophila brevis*, shells from Ampère seamount CP99, 225–280 m (actual sizes 15.2 and 14.7 mm). C. Specimen from Josephine seamount DW61, 200–205 m (actual size 11.2 mm). D. Juvenile shell from Josephine DW61 (actual size 3.2 mm). E. Protoconch, same shell. F. Detail of protoconch-I, same shell. G. Protoconch of an adult specimen from La Revellata near Calvi, Corsica. H. *Coralliophila panormitana* (Monterosato, 1869), protoconch of a specimen from Alboran Sea, *Balgim* sta. DW132, 170 m. I. Detail of protoconch-I, same specimen (scale bars for D: 1 mm; for E,G,H: 500 μ m; for F,I: 100 μ m). Arrows point to the diagnostic difference in the onset of keels.

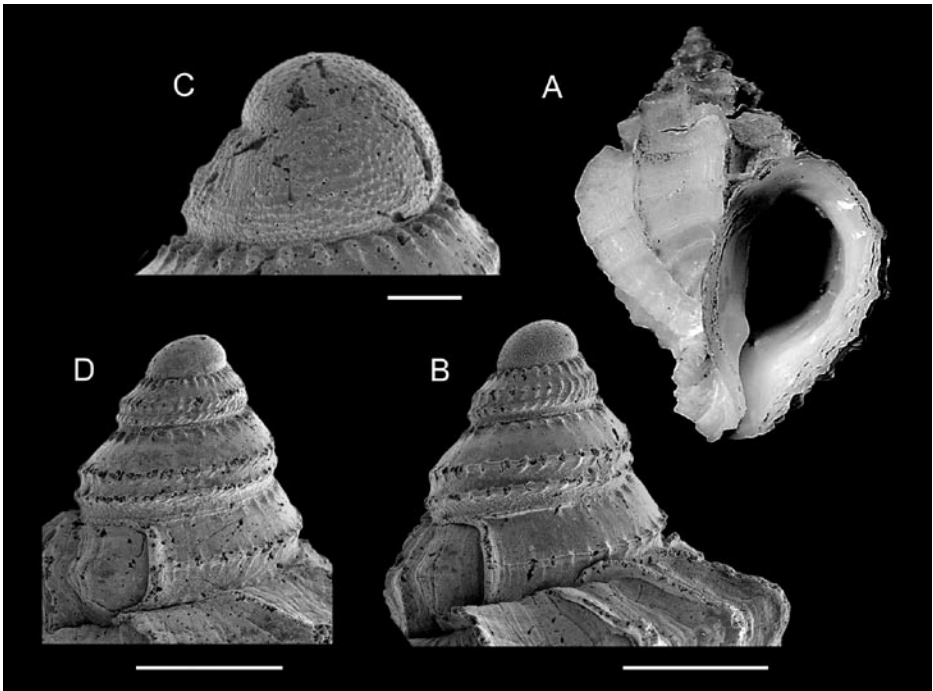


Figure 9. *Coralliophila richardi* (Fischer, 1882). A. Specimen from Plato seamount DW242, 710 m. B. Protoconch of a shell from Plato DW242. C. Detail of protoconch-I, same shell. D. Protoconch of another shell from Plato DW242 (scale bars for B,D: 500 μ m; for C: 100 μ m).

Coralliophila richardi (Fischer, 1882)

(Fig. 9)

Murex richardi Fischer P., 1882: p. 49/type locality: Bay of Biscay, Travailleur-1881 sta. 42 (44°01'N, 007°05'W, 896 m).

Coralliophila lactuca Dall, 1889a: p. 220, pl. 16, fig. 6/type locality: Blake sta. 5, off Cuba, 152–229 fms. and U.S. Fisheries Commission sta. 2669, off Fernandina, Florida (352 fms = 635 m).

Type Material.—*M. richardi*, holotype in MNHN; *C. lactuca*, syntypes in USNM.

Material Examined.—Hyères seamount: *Seamount 2* sta. DW 182 (31°23.2'N, 28°53.5'W, 480m): 1 spm. (19.1 \times 14.0 mm) 3 juv. sh.; DW 184 (31°24.4'N, 28°52.3'W, 705m): 1 spm. (7.5 \times 5.4 mm); DW 186 (31°26.1'N, 28°51.8'W, 1520 m): 1 juv. sh.

Plato seamount: *Seamount 2* sta. DW242 (33°11.8'N, 28°57.0'W, 710 m), 11 juv. sh.; sta. DW247 (33°13.7'N, 29°35.3'W, 580 m), 1 juv. sh.

Atlantis seamount: *Seamount 2* sta. DW263 (34°25.9'N, 30°32.5'W, 610 m), 4 juv. sh. + 1 fr.

Description.—Protoconch of ca. 3.3 whorls, maximum diameter 800 μ m, whitish. Protoconch-I of 0.8 whorl, diameter ca. 280 μ m, pustulose. Protoconch-II 2.5 whorls, with sculpture formed by two spiral keels and small, interrupted axial riblets. Both abapical and adapical keels conspicuous since the first whorls of protoconch-II. Slope from suture to adapical keel flat and shiny, twice as broad as interspace between keels. Axial riblets interrupted, nearly continuous in the very early part of protoconch-II, later developed only next to the suture and again where overriding the keels, to

which they give a serrated appearance. Abapical keel concealed by teleoconch on last protoconch whorl; a third spiral keel visible only in prolongation of the suture on larval shells without teleoconch growth. Interspaces of keels with diffuse wrinkles.

Remarks.—This species has been placed in the genus *Emozamia* Iredale, 1929 (type species: *Murex licinus* Hedley and Petterd, 1906) given the striking resemblance with the type species. It is here conservatively retained in *Coralliophila* s.l. The protoconch resembles that of *C. brevis* in having a smooth, shiny subsutural slope but has a much larger, more globose protoconch-I and more separated keels on protoconch-II.

Genus *Babelomurex* Coen, 1922

Type species by original designation: *Fusus babelis* Requier, 1848.

We use this genus name for an apparently homogeneous group of species where spire whorls are carinated and usually bear a series of triangular projections. The species treated here as *Babelomurex* have often been included in *Latiaxis* Swainson, 1840 (type species by original designation: *Pyrula mawae* Griffith and Pidgeon, 1834), but the latter name should be restricted to a group of Indo-Pacific species with a quite different shell architecture (Kosuge and Suzuki, 1985; Oliverio and Mariotti, 2001).

Babelomurex sentix (Bayer, 1971)

(Fig. 10)

Coralliophila sentix Bayer, 1971: p. 189, fig. 49/type locality: Pillsbury sta. P-876, east of St. Vincent, Lesser Antilles (13°13.9'N, 61°04.7'W, 231–258 m).

Latiaxis sentix carcassii Nicolay and Angioy, 1985: p. 16–18/type locality: off Cape Teulada, southern Sardinia, 374–380 m.

Type Material.—*Coralliophila sentix*, USNM 701155 (Kosuge and Suzuki, 1985 pl. 43 fig. 6, pl. 50 fig. 7); *Latiaxis sentix carcassii*, Museo di Zoologia, Rome.

Material Examined.—Meteor seamount: *Seamount 2* sta. CP151 (30°11.9'N, 28°24.6'W, 585 m), 1 spm. (25.9 × 14.1 mm); sta. DW159 (29°44.3'N, 28°20.4'W, 330 m), 1 sh. (18.7 × 9.5 mm).

Hyères seamount: *Seamount 2* sta. DW184 (31°24.4'N, 28°52.3'W, 705 m), 1 sh. (16.1 × 9.5 mm); sta. DW188 (31°30.0'N, 28°59.5'W, 310 m), 2 sh. (11.8 × 7.1, 17.1 × 10.5 mm); sta. DW190 (31°29.9'N, 29°00.0'W, 750 m), 1 sh. (frag.); sta. DW202 (31°16.5'N, 28°43.1'W, 640 m), 1 sh. (12.9 × 7.8 mm).

Irving seamount: *Seamount 2* sta. DW208 (32°03.9'N, 27°53.9'W, 790 m), 1 sh. (20.8 × 11.1 mm); sta. DW210 (32°02.6'N, 27°56.7'W, 320 m), 1 sh. (15.6 × 10.1 mm); sta. DW218 (31°52.3'N, 28°03.6'W, 480 m), 1 sh. (28.9 × 16.0 mm); sta. DW231 (32°01.5'N, 27°54.5'W, 745 m), 1 old sh. (30.7 × 21.2 mm).

Tyro seamount: *Seamount 2* sta. DW278 (33°55.6'N, 28°23.7'W, 805 m), 1 sh (frag.).

Atlantis seamount: *Seamount 2* sta. DW263 (34°25.9'N, 30°32.5'W, 610 m), 1 jv. sh.

Azores: *Biaçores* 1971 sta. CP41, S-SW of Faial-Pico (37°43.5'N, 29°04'W, 450–475 m), 1 sh.; sta. DP236, S of São Miguel (37°21.5'N, 25°45'W, 500–470 m), 1 sh.

Description.—Protoconch of ca. 3.3 whorls, maximum diameter 740 µm (not distinctly colored, altered but pale on our spms). Protoconch-I of 0.9 whorls, diameter

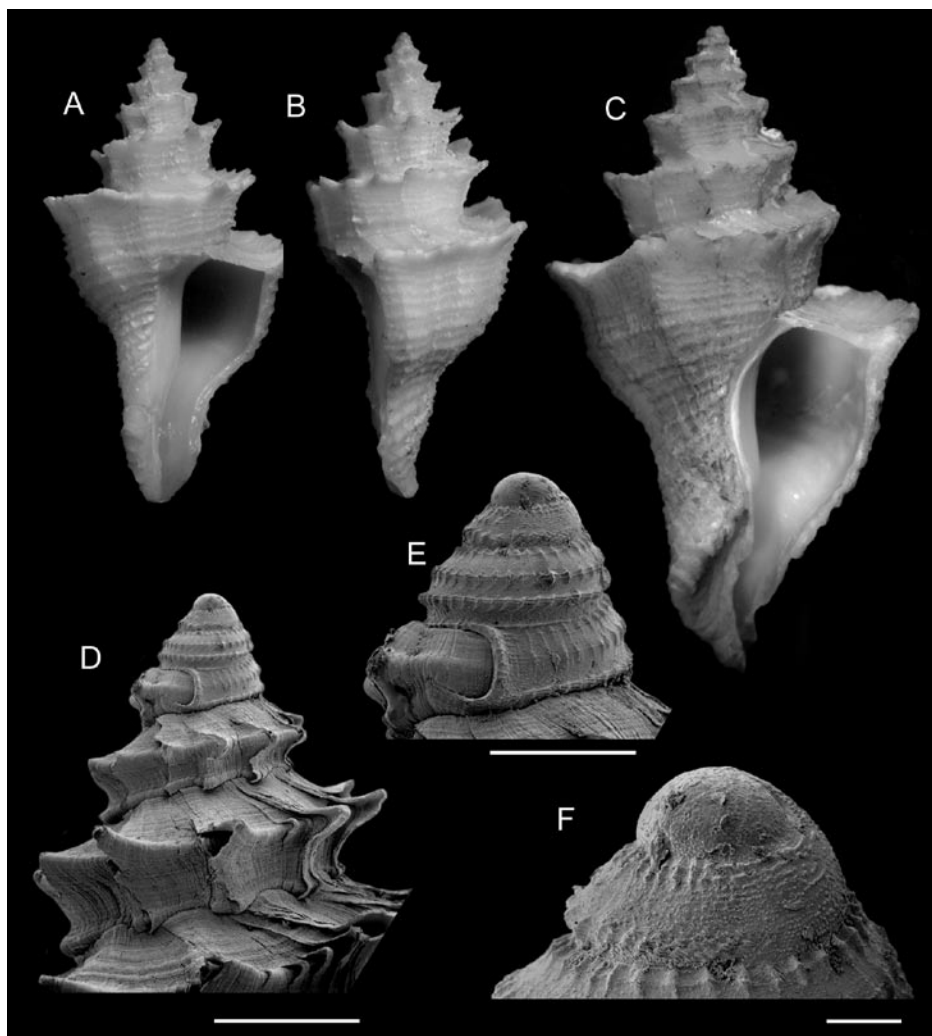


Figure 10. *Babelomurex sentix* (Bayer, 1971). A,B. Specimen from Irving seamount DW208, 790 m (actual size 20.8 mm). C. Specimen from Irving seamount DW218, 480 m (actual size 28.9 mm). D. Top whorls of a specimen from Hyères seamount DW188. E. Protoconch, same specimen. F. Detail of protoconch-I, same specimen (scale bars for D: 1 mm; for E: 500 µm; for F: 100 µm).

ca. 290 µm, covered with pustules which become aligned to form spiral wrinkles on the later part. Protoconch-II of 2.4 whorls, with sculpture formed by two spiral keels and small, interrupted axial riblets. Abapical keel starting earlier than the other on first whorl of protoconch-II. Slope from suture to adapical keel rather flat, hardly broader than interspace between keels. Axial riblets faint, expressed beneath the suture and then again where abutting on the keels and overriding them, giving them a serrated appearance. Slope and interspaces of keels covered by small pustules or wrinkles, specially on the last protoconch whorl. A third spiral keel, concealed by the suture of spire whorls, visible only in prolongation of the suture on larval shells without teleoconch growth.

Remarks.—This species belongs to the complex of *B. kawamurai* (Kira, 1959), which includes taxa originally described from very distant localities, and ranges from Japan, to South Africa in the Indo-West Pacific, to both sides of the Atlantic Ocean. *Babelomurex sentix* was described from the Caribbean Sea, but was recorded from the eastern Atlantic and the Mediterranean Sea (Bouchet and Warén 1985, Nicolay and Angioy 1985). Its presence at the mid-Atlantic Seamounts provides a reasonable explanation of such records. The shells are very similar to *B. helenae* (Azuma, 1973) from the Indo-West Pacific region.

***Babelomurex atlantidis* new species**

(Fig 11)

Holotype.—A specimen (15.5 × 9.1 mm) from Atlantis seamount (*Seamount 2* sta. DW 258), MNHN.

Paratypes.—Meteor seamount: *Seamount 2* sta. DW145 (30°11.4'N, 28°28.5'W, 470 m), 1 sh. (17.7 × 9.5 mm); sta. CP151 (30°11.9'N, 28°24.6'W, 585 m), 1 spm. (16.8 × 9.1 mm); sta. DW 166 (29°36.0'N, 028°22.8'W, 575 m), 1 jv. sh.; sta. DW172 (30°05.1'N, 28°41.5'W, 455 m), 2 sh. (18.5 × 11.1, 20.3 × 12.1 mm).

Hyères seamount: *Seamount 2* sta. DW188 (31°30.0'N, 28°59.5'W, 310 m), 2 sh. (12.2 × 6.8 mm, 15.2 × 9.5 mm) + 2 jv. sh.; sta. DW195 (31°17.0'N, 28°29.4'W, 1775 m), 1 sh. (21.3 × 13.3 mm, canal broken); sta. DW202 (31°16.5'N, 28°43.1'W, 640 m), 1 sh. (8.7 × 5.1 mm).

Irving seamount: *Seamount 2* sta. DW209 (31°59.2'N, 27°55.9'W, 460 m), 1 sh. (19.2 × 10.1 mm).

Type locality.—Atlantis seamount, (33°59.8'N, 30°12.1'W, 420 m), NE Atlantic.

Other material examined.—Lion seamount: *Seamount 1* sta. DW63 (35°15'N, 15°35'W, 630 m); 4 sh.

Distribution.—*Babelomurex atlantidis* n. sp. is so far known only from the type locality and three other NE Atlantic seamounts.

Description.—Shell of medium size for the genus, up to ca. 20 mm high, solid, biconical in shape. Protoconch of ca. 3.5 whorls, maximum diameter 800 µm (not distinctly colored, altered but pale on our spms). Protoconch-I of 1 whorl, diameter ca. 260 µm, pustulose. Protoconch-II of 2.5 whorls, with sculpture formed by two spiral keels and small, interrupted axial riblets. Abapical keel more prominent than the other on first whorl of protoconch-II, keels later becoming nearly equal in size. Slope from suture to adapical keel rather flat, hardly broader than interspace between keels. Axial riblets faint, expressed beneath the suture and then again where abutting on the keels and overriding them, giving them a serrated appearance. Slope and interspaces of keels covered by small pustules or wrinkles, specially on the last protoconch whorl. A third spiral keel, concealed by the suture of spire whorls, visible only in prolongation of the suture on larval shells without teleoconch growth.

Teleoconch of 5.3 whorls in the holotype, with conical spire. Spire whorls convex, strongly keeled, with incised sutures; body whorl convex in the area bordering abapically the keel, then strongly constricted. Siphonal canal long, twisted, open, with an imbricate fasciole enclosing a narrow umbilical chink.

Sculpture on the teleoconch whorls consisting of closely set spiral cords with densely packed imbricate scales, and sharp orthocline axial folds. Cords even in size

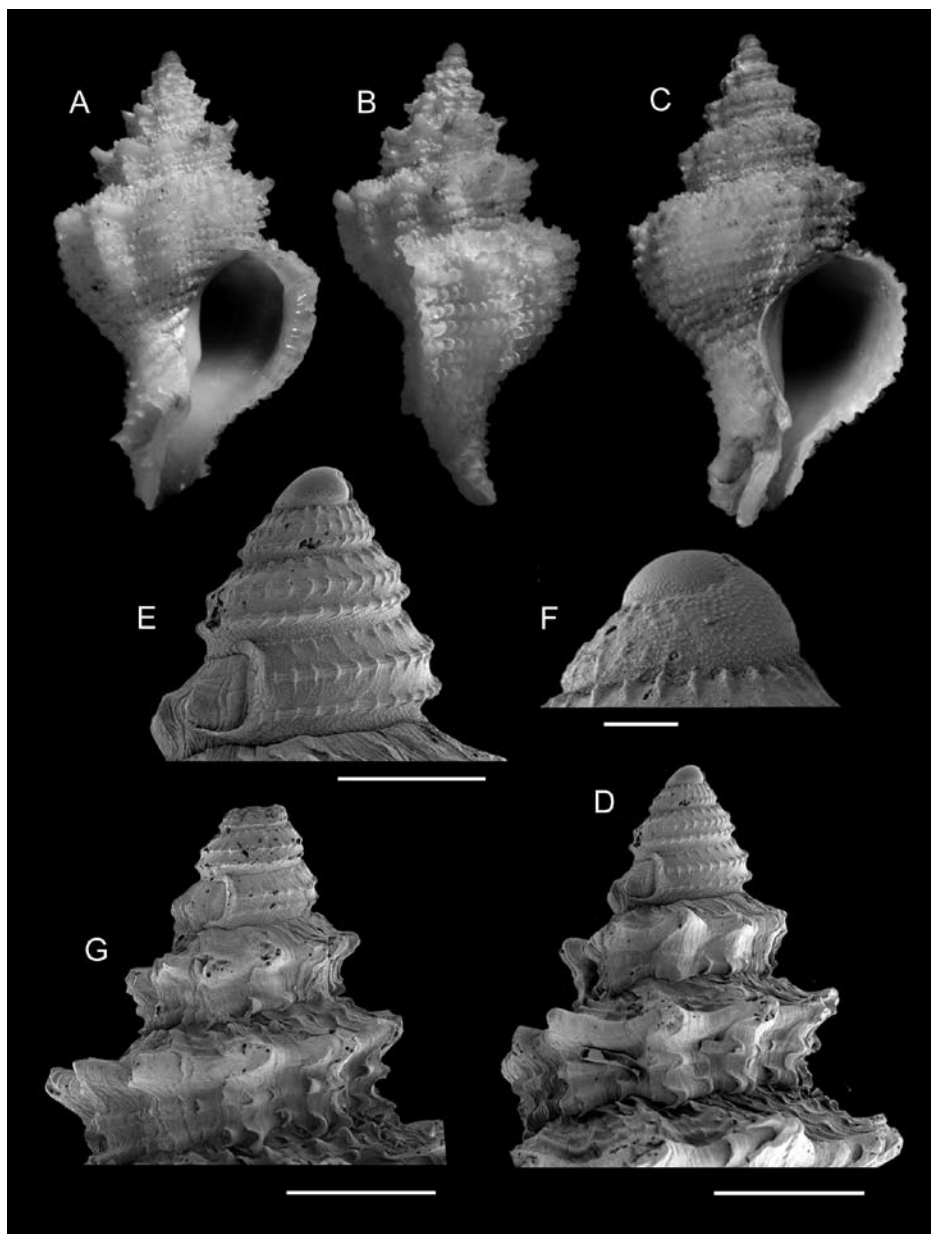


Figure 11. *Babelomurex atlantis* n. sp. A,B. Holotype (specimen) from Atlantis seamount DW258, 420 m (actual size 15.5 mm). C. Specimen from Meteor seamount CP151, 585 m (actual size 16.8 mm). D. Top whorls of a specimen from Hyères DW188, 310 m. E. Protoconch, same specimen. F. Detail of protoconch-I, same specimen. G. Top whorls of another specimen from Meteor seamount DW166, 575 m (scale bars for D: 1 mm; for E,G: 500 μ m; for F: 100 μ m).

except for a larger one on the shoulder keel. Spiral cords on the subsutural ramp, per whorls starting from first teleoconch whorl: I-0, I-2, III-3, IV-4, V(+0.3) 5. Visible spiral cords on the periphery of the whorls: I-1, II-3, III-4, IV-4, V (+0.3) 17. Axial ribs

per whorls starting from first teleoconch whorl: I-12, II-12, III-11, IV-11, V (+0.3) – 10+3.

Aperture gradually tapering towards siphonal canal, rounded adapically; outer lip simple, with smooth edge or slightly notched between cord terminations, forming a shallow inwards embayment on the adapical side, orthocone.

Ground color ivory white, inside the aperture bright white. Operculum and soft parts unknown.

Derivation of name: The epithet *atlantidis* refers to the Atlantis seamount, where the holotype was collected.

Remarks.—*Babelomurex atlantidis* n. sp. can be compared to the species of the *B. kawamurai*-complex and to some of the species ascribed to the (sub)genus *Hirtomurex*. From the *B. kawamurai*-complex (such as *sentix* from the Atlantic, or *helenae* from the Indo-West Pacific) it differs in the more scabrous sculpture of the teleoconch, the much less prominent keel at the shoulder and the subsutural ramp which is convex rather than concave. The species of *Hirtomurex* (such as *C. basileus* and *C. squamosa* from the NE Atlantic or *C. indica* (Smith, 1899) from the Indo-West Pacific) have still more scabrous (squamosose) sculpture and weaker or absent keel at the shoulder. The morphology of the protoconch is hardly different from that seen in *B. sentix*, only slightly larger, whereas that of *C. squamosus*, with a large convex adapical slope and beaded axial riblets, is very divergent.

Babelomurex dalli (Emerson and D'Attilio, 1963)

(Fig 12)

Coralliophila deburghiae auct.: Dall (1889a, b); Springer and Bullis (1956), non Reeve, 1857
Coralliophila deburghiae var. *fusiformis* Dall, 1889: 219 (synonymy uncertain; non *Rapana fusiformis* Martens, 1902, a *Babelomurex*).

Coralliophila deburghiae var. *spinosa* Dall, 1889: 219 (non *Latiaxis spinosus* Hirase, 1908, a *Babelomurex*).

Latiaxis dalli Emerson and D'Attilio, 1963: p. 1–9/type locality: off Guadeloupe, "Blake" sta. 174 (878 fathoms = 1597 m).

Coralliophila basilium Penna-Neme and Leme, 1978: p. 288–289, figs. 12–23, 30–33/type locality: W. Besnard sta. 443 (31.06°S, 49.3°W), off Solidão, Rio Grande do Sul, Brazil.

Type Material.—USNM no. 87215, figured in Kosuge and Suzuki (1985: pl.43 fig. 5).

Material Examined.—Meteor seamount: *Seamount 2* sta. CP138 (30°01.9'N, 28°29.0'W, 300 m), 1 sh. (30.2 × 18.7 mm); sta. CP144 (30°09.9'N, 28°29.04'W, 335 m), 1 spm. (29.3 × 26.8 mm) + 1 sh. (26.4 × 16.2 mm, spine broken).

Remarks.—*Babelomurex dalli* was described from the lesser Antilles and recorded from Gulf of Mexico, and this is the first record in the eastern Atlantic. The protoconch of all specimens were missing but dimensions of the embryos in the capsules of the specimen from sta. CP 144 (ca 50 embryos of 200 µm, ready to hatch as veliger) indicate both a planktotrophic development and that the specimen successfully reproduced.

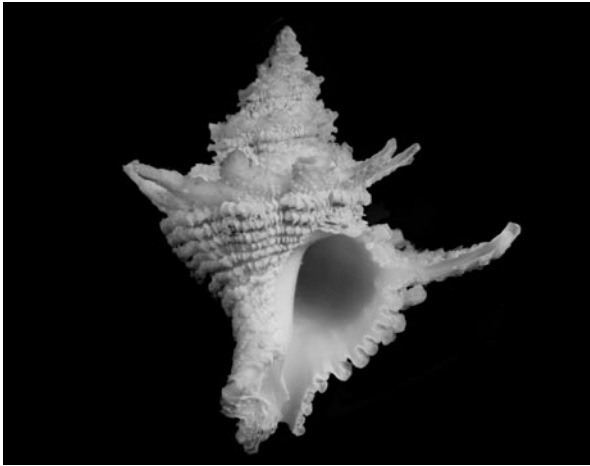


Figure 12. *Babelomurex dalli* (Emerson and D'Attilio, 1963). Specimen from Meteor seamount CP144, 335 m (actual size 29.3 mm).

UNIDENTIFIED SPECIMENS

Several specimens collected on the seamounts could not be assigned to any of the taxa reported above, and almost certainly represent undescribed species. We have refrained from describing them because only one or few specimens were secured. This represents a very small fraction of the total catch but indicates that, when the more rare species are taken into account, the figures given for diversity in this group may still be increased by further collecting and research. Apart from some remarkable specimens listed hereafter, unidentified material includes ca. 30 juvenile or postlarval shells, mainly from Atlantis and Hyères seamounts.

Coralliophila sp.1

Gorringe seamount: *Seamount 1* sta. CP12 (36°24'N, 11°43'W, 1005–1040 m), 2 spm (14.3 × 7.5 mm, 14.2 × 8.2 mm) (similar in shape to *C. aedonia* in shape but having a very different protoconch with two narrow, finely beaded keels).

Coralliophila sp.2

Hyères seamount: *Seamount 2* sta. DW188 (31°30.0'N, 28°59.5'W, 310 m), 3 sh. (4.9 × 3.1 to 6.1 × 4.2 mm); Atlantis seamount: *Seamount 2* sta. DW 255 (34°04.9'N, 30°15.3'W, 340 m), 2 spm. (8.3 × 5.3 mm, 5.8 × 4.0 mm); sta. DW257 (34°04.5'N, 30°15.0'W, 340 m) (7.7 × 5.1 mm, 7.4 × 5.3 mm) (a minute species with distorted adult shell).

Coralliophila sp.3

Irving seamount: *Seamount 2* sta. DW225 (32°08.6'N, 28°10.7'W, 1035 m): 1 sh. (28.7 × 17.5 mm) (a large undescribed species).

CONCLUSIONS

Eleven species of the Coralliophilinae were identified from the material collected during the *Seamount* expeditions and in the Azores (Table 1), and an estimated three more may be present. This represents about half of the total number of coralliophiline species in the Eastern Atlantic (estimated to ca 23–25: M. Oliverio and C. Smriglio, unpubl.). The seamounts in Meteor group (Grand Meteor, Hyères, Irving, Plato, Atlantis) each hosted 3–6 species. Coralliophilines are definitely more scanty in the Lusitanian group, where only Gorringe seamount yielded more than one species, without evidence for established populations.

All species showed a multispiral protoconch with differentiated protoconch 1 and protoconch 2, which may be taken as evidence of planktotrophic larval development (Jablonski and Lutz, 1980). Contrary to other clades where planktotrophic development is present (e.g. the Rissoiidae, Fascioliariidae, Turridae; see Gofas, 1999; 2000; Bouchet, 1990), the loss of planktotrophy is not common in coralliophilines and there is no documented case of such loss in the Atlantic. The Indo-Pacific *Coralliophila suduirauti* Smriglio and Mariottini, 2003 is one of the few species known in the genus with a protoconch indicating non-planktotrophic development.

As a consequence, oceanic currents may play an important role in the dispersal of coralliophilines and must be taken into consideration to explain distribution patterns. In the studied area, the near-surface circulation (the Azores Current) forms a meandering pattern directed essentially eastwards (Johnson and Stevens, 2000 and references therein) with main branches flowing towards Gibraltar to the north and towards the Canary Islands to the south. Despite some associated eddies and countercurrents circulating westwards, this pattern does not favor the transport of larvae from the European mainland towards the seamounts and may explain the rarity of coralliophilines on the Lusitanian seamounts.

In the Lusitanian group, the affinity with the Eastern Atlantic mainland fauna is nevertheless definite with three shared species (*C. squamosa*, *C. brevis*, *C. meyen-dorffii*) out of four, whereas *C. kaofitorum* is shared with the Canaries. In the Meteor group, at least two species (*Coralliophila richardi* and *Babelomurex sentix*) are amphiatlantic and have furthermore been reported from the Mediterranean Sea (*B. sentix* only as empty shells, and *C. richardi* by living specimens (Cecalupo, 1984, Giusti, 1996); one species (*Babelomurex dalli*) was previously known from the Western Atlantic only and two (*C. aedonia* and *B. atlantidis*, plus two unidentified) are not recorded from a mainland shelf.

These patterns of distribution illustrate the role of the seamounts as stepping stones in the transoceanic dispersal of species with planktotrophic larvae. The abundant material collected of *C. aedonia*, *B. sentix* and *B. atlantidis* suggests that these are established and *Babelomurex dalli*, albeit rare, is reproducing on Meteor seamount. It is noteworthy that the seamount material of *Babelomurex sentix* is more than the total known specimens for the Eastern Atlantic and Mediterranean, despite our relatively limited sampling effort. The same observation was made for the Ranellidae (e.g. *Halgyrineum louisae*), which also has long-lived planktotrophic larvae (Gofas and Beu, 2002) and thrive on oceanic seamounts. The meandering and ever-changing pattern of the near-surface circulation over the Meteor group may allow a substantial portion of the larvae spawned there to settle in their native area. Thus, Coralliophiline species likely maintain self-sustaining populations on the seamounts, and

are unlikely to be pseudopopulations maintained by a constant influx of larvae from the Caribbean travelling through the Gulf Stream and the Azores Current.

The species found on the seamounts and islands belong to different bathymetric intervals. The sole shore species is *C. meyendorffii*, which is found in the Azores and understandably does not form any populations at the seamounts. Species belonging to a deep-shelf hard bottoms (*C. squamosa*, *C. guancha*, *C. kaofitorum*, *C. brevis*) are restricted to the Lusitanian group or the Azores, as their preferred bathymetric range is not found in the Meteor group. The remaining species (*C. aedonia*, *C. basileus*, *C. richardi*, *B. sentix*, *B. atlantidis*, *B. dalli*) are genuinely bathyal.

The physiographic setting of the seamounts is unusual in that it has little sedimentary input and allows extensive hard bottoms in the bathyal. This feature may explain that coralliophilines and other epifaunal species may be more abundant on the slope of seamounts or archipelagos than on the mainland slope, despite their ability to disperse over large distances. Some bathyal species are apparently restricted to seamounts (*C. aedonia*, *B. atlantidis*, plus two unidentified species from Meteor group and one from Gorringe) but this may simply be a consequence of the generous availability of bathyal hard bottoms in this environment, and not of limitations to dispersal.

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